COMPLETE LIST OF FUNCTIONALITIES TO BE AUDITED

(This list includes all the functionalities to be done in Phase-2 also. Hence the quotation to be provided considering the functionalities to be audited only in Phase-1 for Phase-1 commercials)

Service Level Agreements and Penalties

1. The successful bidder shall enter into a Service Level Agreement with the Chief Traffic Manager (Operation) for the project and any other officer as directed by the Authority.

2. The purpose of this Service Level Agreement (SLAs) is to define the level of service to be provided by the successful bidder to BMTC for the duration of this Contract. The successful bidder must comply with all SLAs defined below to ensure adherence to project timelines, quality and availability of services. Non-compliance of SLAs will lead to penalties as defined in subsequent section and the SLAs would remain valid for the entire duration of the Contract.

3. Penalties shall not be levied on the successful bidder in the following cases: -
a) Non- compliance of SLAs has been solely due to reasons (acceptable to BMTC) beyond the control of the successful bidder and
b) There's a Force Majeure event affecting the SLA which is beyond the control of the successful bidder
4. The installed system as part of the solution is expected to remain operational for 24 hours per day.

5. Down time is defined as the duration for which the system as a whole or any part of it is not available for the purpose it is installed for. Down time will be reckoned from the time IA or his representative has been informed by the means of Telephone/mobile, fax, email or any other method at the address as specified by the IA. The successful IA shall specify the details of:

First Level:

a) Telephone no. for calling,

b) Fax no.

c) Mobile no. for calling, SMS and WhatsApp,

d) E-mail id,

e) Postal address for correspondence.

Second Level (escalation):

a) Telephone no. for calling,

b) Fax no.

c) Mobile no. for calling, SMS and WhatsApp,

d) E-mail id,

e) Postal address for correspondence.

Non- availability of back-up/stand-by system shall also be counted for downtime calculation. Down time will not be considered for which prior approval of BMTC is taken in writing for preventive maintenance at respective location.

6. For camera /any equipment installed in a Bus/ CCC/ Depot, downtime shall include the service disruptions caused due to reasons including but not limited to camera failures, server failures, workstation failure, mNVR/edge device failures, software breakdowns, networking device failures, UPS failures, electricity circuit breakdown (excluding AC Mains outage) or data network break down. This will not include any equipment/service not provided by the IA.

7. Periodic maintenance of all on-board equipment in all buses shall be conducted by the IA once in every three months and the Maintenance certificate shall be signed by respective depot. IA shall submit a comprehensive report of maintenance to BMTC.

8. IA shall maintain stock of mandatory service spares and the same shall be verified by BMTC on monthly basis.

9. Any damages to the system shall be reported to BMTC and in the Help Desk system. The damages include physical, accidental, electrical short circuit, etc.

10. Any defect/malfunction in the system reported shall be addressed and resolved as per TAT defined in SLA. Delay in maintaining TAT will attract penalty to IA.

11. Service levels agreed with the IA would be monitored by BMTC as per SLA terms and effecting payments would be made for each Quarter after subtracting the total penalties arising due to non-compliance of the SLA

SLA Holiday Period

Ninety days post successful Go-Live shall be termed as holiday period for SLAs, wherein the SLAs shall not be applicable on the IA (but it must be monitored and measured). This SLA holiday period is only for the purpose of streamlining the operations and monitoring of the systems and processes.

Any planned application/server downtime would not be included in the calculation of application/ server availability.

Service Level Monitoring

The Service Level parameters defined above shall be monitored on a periodic basis, as per the individual parameter requirements. The IA shall be responsible for providing appropriate web based online SLA measurement and monitoring tool - SLA Measurement and Monitoring System (SMMS).

- SMMS will monitor the status of all the concerned systems and applications and can be developed by the IA to suit the requirements
- All SLA calculation shall be automated
- The SLA monitoring tool as well as the solution may be tested by a 3rd Party for audit
- The IA shall ensure that proposed SMMS address all the SLA measurement requirements and calculation of applicable penalties
- No manual Data Entry should be performed on the SMMS
- SMMS should be capable of generating role wise MIS reports to project the SLAs achieved in the Month (and Quarter if required) and also the Monthly bill shall be generated through the SMMS
- It would be the responsibility of the IA to generate appropriate MIS reports both in hard and soft copies to ensure accurate capturing of the work carried out during the month.
- Payments to be made for each month would be calculated on the basis of the monthly MIS reports generated from SMMS

In case of severe performance degradation of the system/ services during the Period of Contract, the IA will be expected to take immediate corrective action. In case issues are not rectified to the complete satisfaction of BMTC within a reasonable period of time then BMTC will have the right to take appropriate penalizing actions, including termination of the Contract.

Pre Go-Live:

Please refer ‘Liquidity Damages’ under Section 3: Terms of Reference

Post Go-Live: SLAs for project components								
#	**Service Level Description**	**Measuring Duration**	**Measurement**			**Formula**	**Source Data**	**Remarks**
			Baseline Minimum	**Lower Performance**	**Critical Breach**			
OBU Performance SLAs								
1	Availability of Operational Vehicle Mountable on-board units (ATD, MNVR, Panic	Monthly	**>95%**	**95% to 90%**	**<90%**	a) Percentage of ATD unit availability in a day (X_i) = Performing hours	a) Performing hour = Each Hour (with ignition ON) having more than or equal to	Performance of an ATD can be measured by the no. of packets sent by the device to the central server. In usual circumstances it should be more than 360 (10

Post Go-Live: SLAs for project components								
#	Service Level	Measurin	Measurement			Formula	Source Data	Remarks
	buttons)					in a	300	second frequency
	(With respect to number of schedules of all buses during operational hours)					day for that ATD / No. of schedule hours (with ignition ON) allocated to the ATD in a day b) Z = ∑ Xi / N i=1 to N, N is no. of ATD devices a) (∑ Zi / M) * 100, i=1 to M, M is no. of	packets recorded in the central server. b) ATD location packet having packet generation time, transmission time and server receiving time stamp which is mapped with ITS application backend. c) ITS application	per packet), as that is the minimum number of packets in an hour required to provide good tracking of vehicle. An ATD device will send lesser number of packets, when ignition is off. Ignition off state will happen if the bus is in depot during off service hours, or because the bus has come to a halt due to reasons such as traffic jam, breakdown, etc. While calculating availability of operational

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
						days in a month.	database of operational schedules mapped with OBUs d) ATD log database containing ATD packets being recorded e) For vehicles with ignition OFF even for some time in any performing hour will not	ATD's using schedules served, the time during which ignition is off has to be discounted from the calculation.

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
							be considered.	
2	The Vehicle related online information availability for one and all the schedules shall be available at central server in real time. Appropriate provisions from data backup should be made to achieve the desired levels of service.	Monthly	**>95%**	**95% to 90%**	**<90%**	a) Vehicle Online Information availability for a schedule (Xi) = No. of performing days in a month for that ATD / No. of days in which schedules were assigned to that ATD	Performing day is a day in which the no. of packets received in a day >= Schedule hours (with ignition ON) in day * 7 Here 340 are no. of packets received per hour Defective OBUs reported will not be used for calculation purposes.	In each hour an operational ATD should ideally send 360 packets. Considering a loss of 5% during packet transmission caused by various factors such as unavailability of ATD signals, we can assume that an ATD under every circumstance should be able to transmit 340 packets per hour. This would include backup packets which may be transmitted after a time lag and not in real-time.

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
								A performing
						b) Y = (∑ Xi/N) *100 i=1 to N, N is the no. of OBUs required for servicing all schedules		hour is measured as an hour within a schedule where 340 packets were transmitted by a ATD.
3	Each ATD Unit should ensure maximum 10 second update time for vehicle location	Monthly	**>95%**	**95% - to- 90%**	**<90%**		Hourly Data Packet received to server/cloud report	
4	Bus Camera	Quart	**>95**	**95% to**	**<9**	a) Percentage	a) Uptime = {1-	The mNVR will have system logs

Post Go-Live: SLAs for project components								
#	Service Level Descripti	Meas urin g D	Measurement			Formula	Source Data	Remarks
	Up-Time	erify	%	90%	0%	of Came ra unit availa bility in a day (Xi) = Perfor ming hours in a day for that camer a / No. of sched ule hours (with ATD ON) of the bus in a day b) Z = ∑ Xi / N	[(Downti me) / (Total Time – Schedul ed Mainten ance Time)]} * 100 b) mNVR and ATD having uptime logs that stores and transmit s to ITS backend applicati on. c) The time differen ce in which ATD is running	that contain camera uptime & downtime (off-time) logs. The time in which ATD works in normal condition and camera have downtime stamp will be considered as camera down-time. The camera feed will be pulled out in random sampling method and checked for SLA performance.

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
						i=1 to N, N is no. of Cameras c) (∑ Zi / M) * 100, i=1 to M, M is no. of days in a quarter	normally and camera is down calculate as down-time of particular camera. d) For vehicles with ATD OFF even for some time in any performing hour will not be considered.	
Passenger Mobile Application SLAs								
1	Commuter Mobile	Quarterly	**>99 %**	**99% to**	**< 90**	a) Performance	The performan	

Post Go-Live: SLAs for project components								
#	**Service Level Description**	**Measuring**	**Measurement**			**Formula**	**Source Data**	**Remarks**
	Application Service			**90%**	**%**	availability	availability	
						of all features that mentioned in requirement document. b) Performance availability of commuter hits on server instance.	of application will check from the mobile application server instance performance from EMS system	
2	Commuter Mobile Application screen load time	Monthly	<2 seconds	2 seconds to 5 seconds	>5 seconds	End time (result received) – Start time (API	Screen Load time from Log	The bidder to measure and share log of screen loading time

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
						is hit)		
PIS Performance SLA								
1	PIS availability and On time synchronization of data from the cloud	Monthly	< 10 sec	>10 &<30 sec	> 30 sec	Default value 10 sec or as soon as the bus touches the Geo Fence of Bus stop.		
2	The ETA/ETD related online information availability for one and all the schedules shall be available at passenger information system in real time.	Monthly	**>95 %**	**95% to 90%**	**< 90 %**	ETA/ETD Information availability for a schedule (Xi) = No. of performing packets that communicate with AVLS/PIS application from each PIS display	The performance of PIS data availability from data communication packets from PIS display to PIS server and vice versa.	The EMS system will store the packet communication time and generate statically report of performance

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
						board in		
						day * No of Packets that configure per day * No of PIS - with respect to proposed solution		
3	Accuracy of forecast arrival at bus-stops (ETA Accuracy from AVLS System)	Daily	<=2 minutes	>2 minutes to <=5 minutes	> 5 minutes	“ETA Accuracy ” is calculated for each hour at a given location as the difference between the expected and actual arrival	• By interface provided to SCOC/ Bus Terminus/Depot Operators • Issue logged by Staff/Conductor/Driv	

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
						times.	er/Com	
						This should be within 2 minutes, predicted 15 minutes before the actual measured arrival time	muter.	
Application SLA								
1	**BOAP**	BOAP Availability	**Monthly**	**>97%**	**97% to 95%**	**<95 %**	"BOAP Availability" is defined as the proper functioning of the BOAP with all its key features & functions	The EMS system will store all reports related to server performance and based on that reports application performance SLA measure.
2	**AVLS**	AVLS Availability	**Monthly**	**>97%**	**97% to 95**	**<95 %**	"AVLS Availability" is defined as the	The EMS system will store all reports related to server

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
					%		proper	performance
							functioning of the AVLS with all its key features & functions	and based on that reports application performance SLA measure.
3	**AVLS**	Accuracy of AVLS Incident Reporting	**Quarterly**	**>98%**	**98 % to 96 %**	**<96%**	If any incident reported by AVLS is challenged by the actor/s (driver, conductor or as decided by BMTC) involved in the incident, then the raw data log will be checked for verification. The SLA will be	"AVLS Accuracy" is defined as the accurate reporting of any incident verified through raw data log.

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
							number of	
							accurate incidents reported as percentage of the number of incidents investigated per quarter.	
4	**AVLS and BOAP**	Major Report Data Availability	**Quarterly**	**>99%**	**99 to 97 %**	**<97%**	All the fields in the 'Major' reports should have the relevant and accurate data. The SLA will be number of Major reports with no empty fields as percentage	During the implementation phase, the selected bidder shall submit the entire list of reports to be generated by the system. Based on importance and priority, BMTC will classify them into two categories – 'Major' and 'Minor'.

Post Go-Live: SLAs for project components								
#	**Service Level**	**Measurin**	**Measurement**			**Formula**	**Source Data**	**Remarks**
							of the total	
							number of Major Reports.	
5	**AVLS and BOAP**	Minor Report Data Availability	**Quarterly**	**>95%**	**95% to 90%**	**<90%**	All the fields in the 'Minor' reports should have the relevant and accurate data. The SLA will be number of Minor reports with no empty fields as percentage of the total number of Minor Reports.	During the implementation phase, the selected bidder shall submit the entire list of reports to be generated by the system. Based on importance and priority, BMTC will classify them into two categories – 'Major' and 'Minor'.
ATD Support and Maintenance SLAs								
9	Average rectification time of an OBU	Monthly	**< 24 Hou**	**24 to 48 Hours**	**> 48 Hours**	a) Rectification Time of OBU	Issue logged with helpdesk.	This SLA is being added to ensure that quality of devices used and

Post Go-Live: SLAs for project components								
#	Service Level Description	Measuring Duration	Measurements			Formula	Source Data	Remarks
	and bus operations					devices (incl. camera)		the support provided is resilient enough to meet performance requirements of BMTC. An OBU consists 1 ATD device, 1 panic button, 1 mNVR and 2 cameras. This SLA will require all of the components to be operational. Any one of these becoming non-operational, will trigger this SLA.
						(Xi) = (Issue rectification time - Issue recorded time) / 60 b) Yi = ∑ Xi /N, where i= 1 to N; N is no. of issues logged		
PIS Board Support and Maintenance SLAs								
10	Average rectification time of a PIS Board	Monthly	**< 24 Hours**	**24 to 48 Hours**	**> 48 Hours**	c) Rectification Time of PIS Board (Xi) =	Issue logged with helpdesk.	This SLA is being added to ensure that quality of devices used and the support provided is

Post Go-Live: SLAs for project components								
			Measurement					
						(Issue rectification time - Issue recorded time) / 60 d) Yi = ∑ Xi /N, where i= 1 to N; e) N is no. of issues logged		resilient enough to meet performance requirements of BMTC.
Note								
1	For calculation of SLAs, instances of vehicle breakdown, preventive & corrective maintenance or any manual eventualities will be excluded.							
2	Any fault caused by reasons attributable to BMTC or its employees, or not attributable to OEM shall be excluded from calculation of penalty.							
3	Unless specifically prescribed in any section, all weeks / days / hours mentioned in the above SLAs are to be considered as Calendar days.							
#	**Service Level Description**		**Measurement Duration**			**Formula**	**Source Data**	**Remarks**
Penalty Calculation for the above SLAs								

For baseline performance by IA no deduction is made from the monthly amount. For Lower performance and Breach, deductions in percentages to be made from the monthly amount are shown in the table below.

Audit Finding	Penalty for breach of rectification
Critical Breach	1% of monthly amount per SLA
Low Performance	0.5% of monthly amount per SLA
Baseline Minimum Performance	0

Total Penalty Calculation and Payment

Payments will be made on a quarterly basis as per the terms of payment as stated in the Payment Terms and Schedule under Section 3 ‘Terms of Reference’.

Ordinarily the total amount of penalties levied at any month would not exceed 10% of the monthly amount to the IA for that month. However it is to be noted that in case the overall penalty applicable for any of the month during the contract period reaches 10% for four consecutive months; then the cap of 10% of monthly amount over the penalty levied for any month would cease to exist, from fifth month onwards, resulting in full penalties (as applicable after calculating the breaches) getting levied.

Here it should be noted that applicable penalty would be different from levied penalty. An applicable penalty is the total penalty calculated for the month based upon all breaches as specified for each SLA. In case the applicable penalty crosses 10% of monthly amount at any point then the levied penalty will be capped at 10% of monthly amount for consecutive four months of breaches. In case the applicable penalty crosses 10% of monthly invoiced payment for four consecutive months then applicable penalty will become same as levied penalty.

The quality of services provided by the IA would be considered to have reached ‘Overall Critical Breach Level’, if the total penalty applicable in a month reaches 20% of monthly amount.

The state of ‘Overall Critical Breach’ for four consecutive months will be considered as material default in providing services thus constituting a ‘Material Breach’.

Note:

1. All the SLA reports must be made available to BMTC, as and when the report is generated or as and when asked by the competent authority.
2. It is the right of the BMTC to bring/deploy any external resources / agencies at any time for SLA review

Incentive for Sustained Baseline Performance:

If all the SLAs meet baseline performance in all the months for three (3) consecutive quarters, 0.25% of monthly O&M amount for each SLA will be added to the 3rd quarter payment as incentive.

Example: If all SLAs meet baseline performance in all the months of three (3) consecutive quarters, and the monthly O&M amount is INR X, then INR (N * 0.25% of X) (N is the total number of SLAs) will be added to the 3rd quarter payment.

About Nirbhaya Project

The Government of India has constituted funds to support Women safety measures across public places, including Transport facilities. As part of various initiatives undertaken under the fund, one key initiative is to improve women safety and passenger convenience across public transport undertakings. This initiative includes bringing in an advanced mobile application that can be used by Women commuters to seek remote assistance in case of emergency, tracking movements of women passengers when support is sought by them, putting on-board cameras to monitor on-bus activities, installing panic buttons within busses for women passengers to seek remote assistance in situation of emergency and creating a centralized helpline for providing assistance during distress.

BMTC has received funds under Nirbhaya for implementing such women safety

measures and now intends to utilize it for achieving the envisaged goals. While doing so, it intends to generate maximum value from the money vested with it by utilizing its existing ITS solution and, if need be, enhance it so that BMTC's ITS infrastructure can support Nirbhaya initiatives.

Current Assignment

In an effort to promote safety and convenience in its bus transit system, BMTC has intended to take up a two-pronged approach:

1. BMTC intends to enhance its existing Mobile application with women safety features and a surveillance system. The above system to work efficiently, needs to integrate with BMTC's ITS and its components like Vehicle Tracking System, Ticketing application and monitoring system. But the current Vehicle tracking system in use, though has been extremely useful in meeting the needs of the existing ITS, does not meet the AIS 140 standards prescribed by Government of India. AIS 140 standard adhering Vehicle tracking units help in providing not just feeds to the mobile app but additional richer features to know the location of the bus. Further to this, the surveillance system with the cameras and panic button helps the women to provide an alert to the control room about the occurrence of the incidence. Also, cameras help to know the exact occurrence of incidence along with the ability of recording the incidence. The mobile app will provide a functionality of SOS, which would to be used in case of emergencies. The SOS function will send signals to Sarathi vehicles, which can reach the person by using GPS functionality. In addition, information will be sent to helpline number of BMTC and police control room. Further additional information viz., identifying black spots, travel planner, nearby stops, route, fare details etc., will be provided in the mobile app.
2. BMTC also intends to increase the footprint of information dissemination to passengers about bus routes, buses available and Expected Time of Arrival (ETA) by covering bus stops that hitherto were not covered under the PIS program of ITS. With this objective, BMTC intends to install LED Passenger Information boards at bus stops. The boards will be integrated with

BMTC's ITS system which will allow them to receive information about the bus availability at the bus stops, location of the bus, ETA, etc. Lower waiting time, especially in the night will help women to minimize their risk of exposure to surrounding unsafe elements.

Objectives

It is envisaged that the project proposed for implementation should enable the following objectives:

- Direct impact on safety and security concerns of women
- Improved information dissemination to passengers
- Optimum use of existing infrastructure
- Innovative use of technology to improve customer experience and safety through mobile application
- Provision for real time intervention as far as possible
- Strict privacy and confidentiality of women's identity and information. E.g. placement of cameras so as to not compromise women's privacy, protection of video data collected etc.

Scope of Work

The IA should ensure the successful implementation of the proposed **IMPLEMENTATION OF BMTC MOBILE APP WITH WOMEN SAFETY FEATURE, IN-BUS SURVEILLANCE SYSTEM IN CITY BUSES AND PASSENGER INFORMATION SYSTEM (PIS) DISPLAY SYSTEMS AT BUS STOPS/ STATIONS UNDER NIRBHAYA SCHEME** Project as per the scope of services described below. Any functionality not expressly stated in this document but required to meet the needs of the BMTC to ensure successful operations of the system shall essentially be under the scope of the IA and for that no extra charges shall be admissible.

IA shall implement and deliver the following systems and capabilities for the entire duration of project (24 weeks of Implementation period and 4 years of Operations & Maintenance - O&M period after Go-Live):

- Enhancements over the existing BMTC Mobile App in order to incorporate Women Safety features requiring Development &Testing of these features,

Production and Maintenance of the enhanced Passenger Mobile, along with integration of mobile app with Bengaluru Police's 'Suraksha' app and Karnataka State Police app and any other system required by BMTC. The high-level functionalities of the proposed mobile application are described under Annexure – I.

Regarding devices –

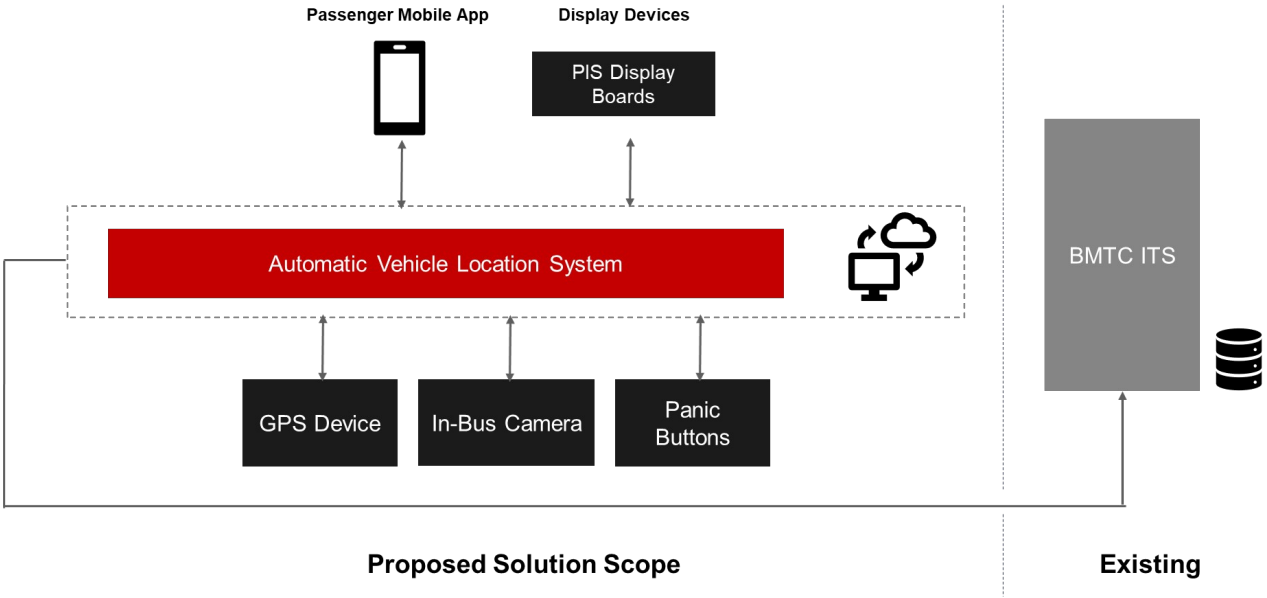
Supply, installation, testing, commissioning, operations and maintenance of the following:

- On-board units in buses consisting:
  - Automatic Tracking Device (ATD)
  - CCTV cameras
  - HD mNVR
  - Panic buttons
- PIS boards at bus stops along with all fittings, fixtures, cabling, meter and required PIS controllers

- Design, development, operations and maintenance of new Automatic Vehicle Location System (AVLS). This AVLS will be responsible for providing information to the passenger mobile app and PIS boards and shall provide all other functionalities as mentioned in Annexure 1.

- Integration with BMTC's existing ITS
- Development, operations and maintenance of a web-based Bus Operations and Analytics Platform (BOAP) to undertake the high-level functionalities as described in Annexure- 1.
- To provide feed to Emergency Response System including integration with BMTC's existing ITS and other systems and robust mechanism for seamless function of devices with electrical system of buses
- Development, testing, installation and maintenance of PIS application for display of Bus Schedule, ETA, health monitoring and other customized messages from command control center.
- Deploy manpower for implementation, operations and management of the proposed solution (Refer Annexure 6 for details)

- Software documentation as per ISO standards of the applications along with user manual and requisite training material
- Include relevant prototypes and screen designs while gathering user requirements and taking sign off
- Carry-out a conference room pilot before release software to UAT for user testing. Under conference room pilot, IA expected to demonstrate the 'Click-through User Interface' prototype, for Mobile App and Web Portal
- Acceptance Testing which will include, but not limited to:
    - Test Case development in collaboration with BMTC
    - Functional testing
- Maintenance of all installed hardware and devices
- Operation and Maintenance covering all the equipment and systems and shall ensure the uptime of all the sub systems as detailed in the SLA during the contract period
- Co-ordination with the OEM Partner/ warranty service provider/ AMC service provider
- Monthly reporting of various monitoring activities in a format approved by BMTC
- Training and Handholding
- Continuous Improvement and Change Request Management



Refer to Annexure 1: “Functional Requirements and Specifications” and Annexure 2: ‘Technical Specifications’ for detailed specifications.

Roles and Responsibilities of IA

- Detailed requirement gathering for all in-scope components and finalization of the same subsequent to discussions with BMTC
- Define Project Implementation Plan - device delivery and installation plan (day wise plan with detailed schedule and resource requirement) and software implementation plan
- Elicit the requirements from BMTC for executing the implementation plan
- Conducting survey, obtaining necessary permissions with assistance from authorities for deployment of PIS devices on bus stops and stations
- Submit system design & installation plan including a set of single diagrams depicting its layout plan for implementing the junction boxes, single phase energy meters and voltages stabilizers for PIS LEDs at bus stops

- Delivery of all hardware as per finalized BoQ and take signoff on delivery challan (no hardware should have date of manufacturing older than 6 months as on the date of delivery to BMTC)
- Installation & commissioning of hardware as per installation plan
- Define the formats for data packet exchange to the AVLS, BOAP and existing ITS system
- Due-diligence of the existing ITS application, which has built-in experience of tracking and managing buses and wherever possible should reuse the AVLS application and underlying source code. They should use the APIs provided by BMTC to access the data (e.g. master data) from the ITS to be used in the AVLS/BOAP application.
- Adhere to defined SLAs and timelines
- Submit the test cases & installation acceptance report
- Preventive, repair maintenance and replacement of hardware
- In case of scrapping of buses by BMTC, the IA has to decommission the on-board units and re-install them in any other new/existing vehicle or maintain inventory, as decided by BMTC. This should be done at no extra cost.
- Develop maintenance and user manual and SoP document for post maintenance period
- Deploy efficient and qualified manpower on field for installation and commissioning
- The overall management of SLAs and adherence to it would be the responsibility of the IA
- Monitoring Performance and Service Levels
- Sharing the application and server logs
- Sharing Root Cause Analysis report for any downtime or unavailability of the mobile application and field devices (OBUs, PIS boards)
- Security Administration and monitoring Security Incidents
- Monitoring support for BMTC working hours and attend incidents received through Incident Management Module, calls and emails.
- Backup and Business Continuity
- Develop a Risk Management Plan enlisting the risks to the project and mitigation plan and ensure compliance to the same

- Integration with any BMTC internal application/payment application/external application in future as per requirements of BMTC
- Capacity Building for BMTC which includes:
    - Support during execution of acceptance testing
    - Preparation of system documents, operation manuals, user manuals, performance manuals, etc.
- Operations & Maintenance:
    - Annual Maintenance which includes periodic maintenance services for the devices and all software (mobile application, AVLS, BOAP and all device system software installed as part of project) for a period of 4 years and conducting periodic audits of the project from a third party, if required or instructed by BMTC
    - Provisioning and deployment of technical manpower for maintenance and issue resolution of all software and hardware/devices/equipment for the period of 4 years
    - Conduct security audit of the applications by a CERT-IN empanelled auditor
    - Adherence to latest Industry Standards, guidelines as specified by government authorities
    - Periodic submission of warranty/AMC records

Annexure 1: Functional Requirements and Specifications

a. Passenger Mobile App

The requirements of passenger mobile application are as follows:

- Enable passenger to get more specific information
- Real-time service information
- Feedback & Emergency alert management from passengers
- Journey planning functionality
- The application shall be available in both web version and mobile application
- The mobile application shall have look and feel consistent with BMTC's branding

- The mobile app and the web version should be available in two languages – English and Kannada
- The passenger should be able to enter the route, direction, and bus stop ID, or select these from a sequence of drill down lists or from a map
- The application shall default to display the predicted number of minutes until arrival of the next bus
- The main objective of application shall be safety & security during the trip ride so application shall have functionalities to generate SOS/Emergency from its mobile application
- The backend system should be intelligent enough to track that mobile application user once any SOS/Emergency generated from it. The application shall also identify the exact bus & its crew details from the alert.
- The user of mobile application shall access it with proper registration & Know your Passenger (KYC) process. The minimum details in KYC shall be as follow but not limited to it.
    - User Name
    - Identity Photo
    - Email Address
    - Mobile Contact No
    - Gender
    - Any KYC Document Details
- The application shall have functionality to see its previous tickets booking and completed trip rides. The module shall show upcoming trip ride if user books it in advance for same day.
- The application should be integrated with BMTC's SMS service for passengers to receive updates through SMS and IVRS for in-app redirection to calling the IVRS for information.
- Integrations with KSRTC/NWKRTC/NEKRTC applications
- Integrations with Metro/Cab Service/Bike/Bicycle Rental, other transport operators
- The application shall be developed in native form that it shall support all type of mobile application resolution size & technology irrespective of operating system. The application shall support Apple and Android operating system.

- The application shall allow user to customize the app that they would like it by choosing or allowing the use of phone data i.e. Allow use of location, allow use of contact, allow use of mobile camera etc.
- The application should be developed in way that ask minimum amount of information type by commuter to reach the goal.
- The map location feature of mobile application shall work in offline mode.

Application Features:

- Find Nearby Bus Stops (Geo-location based and Text Search)
- Around the Bus Stop
- Estimated Time of Arrival (ETA) of the Bus at the Bus Stop
- Estimated Time of Arrival (ETA) to Destination
- Route Planner
- Fare Calculator
- Timetable
- Favorites (Passenger's favorite/frequent route and bus stops e.g. Home, Workplace, etc. on Route Planner)
- Women's Safety SOS button
- SOS message to the local vehicle tracking device in the bus
- Sharing Location with contacts
- Redirecting to mybmtc.com for hiring a BMTC Bus
- Redirecting to mybmtc.com for buying Bus Pass
- Link to KSTDC portal for detailed information on Bangalore tourism
- Feedback

Functional Specifications:

1. Find Nearby Bus Stops

- The user can use the app to find nearby bus stops using integrated Maps with Geo-location of the user
- The bus stops will be marked with icons on the map
- User can also search for nearby bus stops by keying in the area or the address

2. Around the Bus Stop

- Around the Bus Stop functionality enables the users to search for Places of Interest (POI) around the Bus Stop.
- Users can search for ATMs, Restaurants, Facilities at the Bus Stop and more.
- The POI will be marked on the map and will show the walking path or bus route to the POI from the user's current location.

3. 3. Estimated Time of Arrival (ETA) of the Bus at the Bus Stop

- The App can display the route of the specific Bus keyed in by the user.
- App can indicate the current position of the bus based on the scheduled timetable and an estimation will be computed based on the data from the vehicle tracking device
- App will also show how much the bus is crowded aided by ETM ticket data
- At each Stop of the Bus, the app shall indicate the ETA at the Stop and ETA at the User's Location

4. Estimated Time of Arrival (ETA) to Destination

- The user in the bus can key in his/her destination and the app can indicate the current position of the bus in the route map, and ETA to the user's destination.
- User can set alarm for 5 minutes before his destination.
- The app can use the geo-location of the user to track the position of the user to estimate the arrival of the destination using Maps

5. Route Planner

- Route Planner in the App assists the user plan his/her journey.
- User needs to key in his/her origin and destination.
- In the search results, user is able to filter options with various options such as A/C or Non A/C Buses Only, Shortest Time, Fare, Maximum No. of Changes / Transits.
- The route planner functionality also displays the Fare for the selected route.

6. Fare Calculator

- User can enter the Bus Route, Type of Bus, Boarding Point and Destination.

- The app will retrieve the fare accordingly. The app shall connect the MYBMTC.COM site to retrieve these data on the fare.

7. Timetable

- User can select the bus stop or the app can suggest the bus stop from Geo-location of the user.
- The app shall display the buses passing the bus stop in various intervals for the day.
- User can also select the origin, destination, and route no, to display the timetable.

8. Favorites

- User can choose his/her favorite or frequented (e.g. Home, Workplace, etc.) on Route Planner bus stop or bus route to get instant updates
- This feature will enable the user to quickly retrieve the buses arriving at his/her favorite bus stop.
- User can also enable for Push Notifications for his/her bus stop /bus routes

9. Women's Safety SOS button

- The SOS button must be on the home screen of the app and needs to be very prominent
- Tapping on the SOS button will trigger the following events:
    - Send an SMS with the current location to the list of contacts from the phonebook pre-selected for emergency contact
    - Send the current location and quick video to Bengaluru Police's women's helpline through integration with the 'Suraksha' app for women safety
    - Send an SMS about the alert along with the current location to the nearest Sarathi vehicle
    - Send short voice message, picture and video in case of distress to the list of contacts from the phonebook pre-selected for emergency contact
    - SOS message to the local vehicle tracking device in the bus

Tapping on the SOS button will connect with the vehicle tracking device in the bus and will in turn send alert to the BMTC control room

10. Sharing Location with contacts

- User will be able to send current location to a pre-selected list of contacts from the app
- User can select communication options from SMS, WhatsApp message, Facebook message and e-mail.

11.Hire a BMTC Bus

- Tapping on 'Hire a BMTC bus' will redirect the user to the mybmtc.com website

12.Buy Bus Pass

13.Link to KSTDC portal, AWATAR or other portals (as required by BMTC)for detailed information on Bangalore tourism, online booking, etc.

- Link to KSTDC portal for information on all popular tourist locations and other amenities like hotels, guest houses, trains, etc. in Karnataka, user can tap on the 'Visit Karnataka Tourism' button which will re-direct him to the KSTDC website. Link to AWATAR portal to redirect to KSRTC AWATAR portal for online ticket booking.

14.Feedback

- The mobile application shall have functionality to generate trip-ride feedback from passenger. The feedback module should include following functionalities but not limited to only this.
- Feedback on drivers driving behaviors
- Feedback on conductor's behavior
- Feedback on cleanness of Bus
- Feedback on stoppage of bus
- The mobile application shall have functionality to generate feedback from the passengers with set parameters.

Note:

- The IA will have to assess BMTC's existing commuter mobile application and decide on the functionalities/features it wants to utilize after customization or enhancement (if needed). If it is felt by the IA that new functionalities

have to be developed for making the app suitable for women safety and providing improved services to the commuters, it may do so.

- In future, the mobile app should have functionalities of enabling NCMC and any other full-fledged payment mechanism.

b. Automatic Tracking Device and Emergency Button Specifications

The Automatic Tracking Device (ATD) and Emergency Buttons should be fully compliant to AIS 140standard (as amended from time to time) and should be type approved from testing agencies authorized under CMVR.

In addition to above, the ATD should meet the following requirements:

i. The ATD shall provide the output as per NMEA0183 for GPRMC packets to PIS controller through RS232 at minimum frequency of 1 Hz.

ii. ATD should support Over the Air (OTA) firmware and configurational parameter updation.

iii. ATD should send device health monitoring parameters.

iv. ATD should send location data @ 10 seconds during bus ignition on and @1 minutes when bus ignition off.

v. ATD should have inbuilt battery with a backup of at-least one hour

vi. ATD should come with normal SIM slot with single carrier communication/ e-SIM. The data communication from the ATD with all incidents and video feed should be precisely on server/cloud provided by BMTC.

vii. There shall be 1 emergency button/panic button installed in each bus.

viii. The emergency button should be ‘Normally Closed’ (NC) type

ix. On pressing of any of emergency button the emergency alert should be sent to the configured IP address. In the absence of GPRS network, the alert should be sent as SMS.

c. CCTV Camera Requirements

The CCTV system with an Integrated Emergency System should be certified from ICAT/ARAI.

The CCTV system will consist of:

i. **Two** number of IP Cameras
ii. Mobile network video recorder (mNVR)
iii. Emergency Buttons

In case of press of emergency button, the video recorder mNVR will get the input regarding the emergency alert. The video recorder will start sending the visuals to the backend at a configurable frequency along-with vehicle registration number, camera identifier and time stamp.

d. Automatic Vehicle Location System (AVLS)

#	Minimum Functional Specification
A	**General Features**
	The AVLS – Automatic Vehicle Location System shall be primarily developed for tracking & monitoring of bus movement with real-time basis through GNSS/GPRS technologies.
	The AVLS application shall enable effective management through decision support system by collecting, collating and storing of information on real-time basis about the public transport operation.
	All location related data and AVLS process data shall be store in manner that allows direct access by the software for at-least 180 days.
	The AVLS system shall use GIS Map services for availing location services.
	The system shall enable BMTC to drill and analyze information and online data in a multi-dimensional manner. Comprehensive analysis and reporting capabilities are expected to be part of the system delivery which matches the best practices around globe.
	The system shall be web based and utilize high resolution digital map to show real-time position of the buses/fleets.
	The system shall be integrated with the bus stand announcement system

#	Minimum Functional Specification
	to provide information about arrival and departure details based on location data.
	The system shall expect to have enterprise capabilities which enables multiple user types to be enabled to carry out various functions like Alarm Management, Schedule Adherence, Speed Management, Stoppage management, Route replays, bus tracking dashboard etc.
	The GUI of AVLS application shall develop in vision of CCC- Operator for easy to use and understand.
	The architecture of AVLS system shall be dynamic so it shall be easily integrated with other system of BMTC.
	The AVLS application shall have in-built multiple dashboard as per requirement of BMTC.
	The AVLS Application GUI shall be based on standard windows control or equivalent.
	The AVLS application shall be web based and user in Widespread access from multiple physical locations.
	The AVLS System shall only be accessible by authorized persons, controlled using login and password protection.
	The AVLS system shall maintain a transaction log that records all users that access reports, the reports accessed, edits and changes to the database and the system logon and log-off times.
	The system shall be work on feedback loop mechanism where processed information data from the other system becomes the next iteration of operation.
B	**Operations Dashboard**
	The operation dashboard of AVLS application shall display minimum information as include but not limited to this: • Real-time Status of Bus • Standby Bus • Idle Bus • Running Bus

#	Minimum Functional Specification
	• Breakdown Bus • Under Maintenance Bus • No-Communication • Real-time Speed of Bus • Real-time incident count of Bus • Near-by Stop • Last Updated Time of GPS Packet • Last Location/Station
	The operation dashboard shall have Map icon so operator can directly access the live location of bus from that map button.
	The module shall have feature to show list of bus in each category when user access any status.
	The tabular display entries and the map display symbols for these buses shall use distinct and configurable color codes.
	The system buses shall be shown concurrently in the GUI with both static and real-time data as parameters. Additional flexibility shall be present to select groups of buses based on criteria defined by the BMTC.
	The operation dashboard shall have feature to show the status of trip in running with its stage completion online diagram with distinct color code based on Schedule Adherence Status
	The operation dashboard shall display Schedule Trip Start Time & Actual trip Start Time for understanding of operator.
	The operator dashboard shall be work in hierarchy(Central > Division> Depot) format for vehicle list. The operator of depot shall see only parent depots buses in operation dashboard.
	On this dashboard shall be relevant schematic layouts with all nodes connected & shown on the GUI with real-time status.
	The legends of all category of buses shall be display in different color codes in operation dashboard.
	The operation dashboard shall display each status category of buses based on reverse chronological time order in list tabular view.

#	Minimum Functional Specification
	The operation dashboard shall loosely integrate with Scheduling & Dispatch management and Incident Management System.
C	**KPI – Key Performance Indicator Dashboard**
	The KPI dashboard shall be developed in a way to communicate insights from Performance Indicators to BMTC which would be beneficial from the perspective of operational improvements i.e. trip adherence by start/by end, functional on-board devices, km/bus, trips/bus, schedule adherence on pick hours/non pick hours, etc.
	The KPI dashboard shall showcase following Indicators but not limited to: • Buses in Operation • Preventative Maintenance - Plan Vs Actual Model • Incident Count • Earning Per KM • Running average of buses • Crew Uses • Bus Utilization • Schedule Adherence
	The KPI Dashboard shall have quick and concise overview of the Indicators with potential flags.
	The operator/user shall have appropriate and accessible way to display the dashboard. The dashboard shall have pre-configure time line for each indicator.
	User is free to set those timelines from day to day or Month to Month.
	The KPI dashboard shall develop in way that it looks, navigate and understand easily for any new user.
	The KPI Dashboard shall display at least last 1 year’s data for display of indicators.
D	**Live Bus Location Module**
	The module shall allow operator to view live location of bus with

#	Minimum Functional Specification
	following information including but not limited to this: • Type of Bus • Live Location of Bus • Real-Time Speed of Bus • Last Packet Date & Time • Parent Depot & Division Information • Crew Details (If in Operation) • Map Layer Details (If GIS Map Layer) • Bus Stop Locations (Filter basis) • Route Geo-fence (Filter basis) • Status of Vehicle (Running Standby, No-Communication etc.) • Device ID
	The module shall feature to show the other buses in same route using pop-up message.
	The map display icon for each vehicle location should provide the individual choice for each workstation of whether to display as the label the vehicle, block or route.
	The display icon of the bus on the map shall provide an indication if the latest reported location being displayed is older than the reporting interval or not, to identify packet losses and delay in communication transfer.
	The Live vehicle module shall have following filters for user to better access and interface of module: • Nearby stations/stops with its geo-fences • Route profile filter • Bus Running Profile
	The system shall allow replay for a single vehicle, selected set of vehicles or all vehicles on the selected map view on real-time basis.
	The module shall have feature to show the Bus on horizontal scale with stations list and current position on scale.
	The scale tracker module shall have to display the schedule time of arrival on each station and estimated time of arrival of each station by

#	Minimum Functional Specification
	bus.
E	**Route Replay Module**
	The module shall allow user to access historic activities and running pattern of buses.
	The module shall allow users to view the map, including a selectable combination of the source map layers and new layers, at various user-defined zoom levels.
	The module shall provide controls to view the entire sequence of reported locations from the beginning of the time period or to step through the sequence incrementally forwards or backwards.
	The module shall allow replay for a single vehicle, selected set of vehicles or all vehicles on the selected map view for selected time period.
	Module shall consist of multiple features for location playback to allow variable speeds and time period selections for ease of replaying.
	The module shall allow selection of any time period for the historical data of 120 days from the database.
	The location playback data shall include location, vehicle data and headway adherence data.
	The system shall allow the ability to use playback without exiting from the current operational dashboard view.
	The module shall be able to store a playback in a format that can be exported for viewing on any computer.
	The module shall have same type of filters but not limited to this as mentioned in Live Bus Location Module.
	The bus running pattern shall be marked with distinct color code in route play back module including but not limited to this: • Green Color Path : Running under stipulated speed limit • Red Color Path: Running with over-speed • Yellow Color Path: Running with under-speed • Orange Dots Path: Any Incident

#	Minimum Functional Specification
	• Black Spot: Any SOS happed through Panic Button
	Route play back module shall have feature to show the buses with its running profile and all details.
	The route playback module shall have functionality to clearly indicate the route violation incident by Bus.
	The system shall have ability to select the appropriate data from the database to show the route playback in jitter free and smooth mode.
F	**Planning & Scheduling Module**
	The module shall have feature to enable operational efficiency in daily operation of buses and crew.
	The primary objective of the module is to cater to the transit trip plan/ schedule of buses ,crew based on planned schedule or revised schedule, subsequently based on real time route condition monitoring.
	The module shall enable optimization of end to end transport operation management by developing the route network, trip plans , timetable & crew rostering etc.
	The module shall have option to show the daily plan versus actual operation of buses and crew in real-time basis.
	The module shall combine GIS and AVLS to coordinate different transit routes function. The system shall also loosely integrate with other system to optimize the route plan based on transport indicators.
	The module shall be capable to develop the network of transit operation including but not limited to this: • Static Scheduling Plan • Fixed Scheduling Plan • Dynamic Scheduling Plan • Demand Response Scheduling Plan • Free Scheduling Plan • Customized Scheduling Plan • Night-out schedule Plan • Holiday Scheduled Plan

#	Minimum Functional Specification
	The module shall be capable to provide data on scheduling adherence, crew reporting, route condition monitoring, emergency & incident interface through integrate with AVLS & other systems of BMTC
	This module shall be capable to enable Creation/modification of the data universe i.e. definition and creation of routes along with bus stops, depot & terminus. Definition / modification of timetables by defining shifts and plans.
	The module shall enable BMTC to make modification as and when required. The system should support templates, so that end users of the application would re-use existing formats and create crew timetables easily.
	This module shall be capable to add/modify trips (inbound, outbound, headway) to timetables (mentioned previously). Bus demand management based on trips planned, Layover depot time management, dead run management, driver changeover management.
	The module shall have capability to predict the best routes based on the indicative parameters of BMTC i.e. Revenue Calculation, EPKM, KMPL, Passenger Load, Ridership, Peak & Non-Peak time etc. to optimize its operation.
	The module shall be use for enabling defined SOP – Standard Operation Procedures of BMTC for crew management.
	The module shall be work on feedback loop mechanism where processed information data from the other system becomes the next iteration of operation.
	The module shall have integrated functionalities to manage the operation of BMTC including but not limited to this: • Network Plan & Timetables • Trips & Vehicle Planning • Crew Schedules • Roster and Dispatch (Operations) • Crew Efficiency • Performance monitoring

#	Minimum Functional Specification
G	**Dispatch Management Module**
	The module shall design to help automate the routine and scheduling process and providing a simple way to coordinate routes, services and deliveries of operation efficiently.
	This module shall give operator complete control of Trip process, Track location and status of buses.
	This module shall have capability to collate the data from different modules of same system or any external sub-system and quick response to operator to manage the dispatch of buses.
	The dispatch management system shall have capability to filter out the vehicle list including the following list but not limited to this: • Dead KM • Running KM • EPKM • KMPL • Crew Utilization • Bus Utilization percentage • Incident/Alert
	The module shall have ability to plan dispatch of depot vehicle using a depot Plan. Proposed solution shall manage multiple depots from the one screen based on roles & responsibilities.
	The module shall have provision to easily swap work between crew and buses .
	The module shall have provision to handle the SoP- Standard Operating Procedure for on-road vehicle changes due to accidents, breakdowns etc.
	The module shall manage the driver information and handle the SoP-Standard Operating Procedure of the same to make BMTC safer.
	The module shall seamlessly integrate with BMTC’s SMS gateway for any information pass to crew or group of mangers.
	The module also shall notify the crew about the vehicle & its support

#	Minimum Functional Specification
	crew through message.
H	**Incident Management Module**
	The module shall cover & record all type of incidents and issues that will be pre-configured in system by administrator/operator. The IMS module shall also integrate those data with other system to make system efficient. The BMTC users will be granted role-based access to login and raise incident/issue tickets.
	The incident management module shall capture the following alerts but not limited to this: • Issue with applications – mobile app/AVLS • Hardware Devices – ATD, Camera, Panic Buttons, mNVR • Running with Over-speed • Running with Under-Speed • Missed Stoppage • Un-authorized Stoppage • Delay in Trip Start • Dwell Time • Early in Trip Start • Bus Bunching • Bus Breakdown • Panic Alert • Harsh Acceleration • Harsh Break • Panic Alert • Tamper Alert • License Expire Alert • Routine Maintenance Renewal • Road Permit Renewal • Vehicle Insurance Renewal • Geo-fence cross • Route Violation

#	Minimum Functional Specification
	• Bus Running without Schedule/Trip • Bus Running with Dead KM • Improper Headway
	The module shall have functionality to configure it from front end and zero dependency on back-end application. The administrator/transport manager should be able to configure it with same login credential.
	The configuration module shall have options of setting responsibility matrix at level L1, L2, L3 and Servility matrix of S1, S2 and S3 for all types of incidents.
	The configuration module shall seamlessly integrate with master module of user management for notification of incident through SMS Email and Dashboard Notification.
	The module icon shall blink to operation dashboard and generate unique identity number for each incident. The hierarchy of BMTC shall allot the Incident alert to down hierarchy & track the same till successfully close of it.
	Each type of Incident/alert shall be closed by the operator and notification of each stage shall be share with Transport operation head.
I	**Report/MIS Module**
	The module shall be able to generate all reports separately for different sub-systems under operation.
	The report shall be classified in following manner but not limited to this: • Statically Report • Performance Report • Incident Reports • Management Information Reports • Exception Report • Summary Report • Monitoring Reports • Historical Reports • SLA Reports

#	Minimum Functional Specification
	Any portion of the transactional database shall be exportable in standard formats (such as comma separated value (.csv, xls, xlsx files etc.) for analysis in third party programs.
	It shall be possible for users to build custom reports from the data in the transactional database with support tools such as Crystal Reports and MS Excel. The reports should be customizable for various time periods through the dashboard of the reporting system.
	A data dictionary shall be provided to Authority to facilitate development of custom reports.
	The module shall provide enough summarized and detailed data, including features to generate standard report based on pre-established criteria, as well as required reports based on a user-definable set of search criteria.
	All reports shall be generated using a query language and standard query engine that provides flexibility for future updates, and for creation of new reports.
	The details of static report contents including but not limited to this only: • Monthly summary reports broken down by bus and route type; • Bus Location by date/time, location, and other parameters • Schedule adherence reports for depot locations, bus terminals and bus stops • Bus bunching report • Driver performance report consisting of bus stop skipping, harsh acceleration, harsh deceleration, over speeding, etc. • Fraudulent activity reports with the hardware (Tampering reports) • Faults and errors • Bus trip reports; • System exceptions reports • System performance and activity reports • Financial reports SLA violation report based on the business rules

#	Minimum Functional Specification
	specified in bus operations tender. • Travel time reports between stops • Reports on events that hinder movement of buses
	The report module shall provide with functionality of ad-hoc reporting to user or group of users through SMS (Summary Report) and Email (Detail Reports)
	It shall be possible to aggregate data (filter) for reporting, at a minimum, by: • Date/Time • Origin • Destination • Location • Equipment Serial Number It shall not be necessary that values be consecutive for the purposes of aggregation (e.g. non-consecutive months).
J	**Data Master Module**
	Data Master module shall be used to define and manage the critical and one-time data of organization to provide data integration through single point of reference. The data master module shall include reference data with set of permissible values, static data, analytical data that support the decision making.
	The data master module shall be single database structure for each type of data sets in BMTC. The data master module shall be deployed in a single location where all other applications and sub-systems fetch the relative data through API/XML method.
	Data Master Module shall have the objective of providing processes for collecting, aggregating, matching, consolidating, quality-assuring, persisting and distributing such data throughout an organization to ensure a common understanding.
	The data master module shall have each type of pre-configure data structure in .xls format so user shall upload the data sets in .xls format

#	Minimum Functional Specification
	to system and zero dependency on backend of system.
	The data master module shall have facility to export the data in .xls, .pdf and .csv format for differ analytic purpose.
	The data master module shall include the following type of data sets but not limited to this: • User Master Data Sets • User Type Data Sets • User Role Data Sets • Device Master Data Sets • Bus Master Data Sets • Bus Type Master Data Sets • Service Master Data Sets • Route Master Data Sets • Route Part Master Data Sets • Incident Master Data Sets • Incident Type Master Data Sets • Report Master Data Sets • Depot Master Data Sets • Station Master Data Sets • ETM Master Data Sets from existing ITS system of BMTC • Crew Master Data Sets • Crew Type Data Sets • Shift Master Data Sets
	The module shall generate alert when user import any improper data sets into system. The system shall have capability to learn from existing data sets of master module.
	The developed application should successfully integrate with GTFS (General Transit Feed Specification) for entire fleet of BMTC. It should also be enabled to integrate with third party systems with the prior approval of BMTC.

e. LED PIS Board:

- Displayed messages must be readable in high bright, day light
- The frequency and period of information display on PIS display shall be configurable from central location for advertisements and other transit information
- Information display requirements, as per specifications indicated shall be provided in control rooms at locations specified by BMTC
- All displays for PIS shall have a configurable refresh rate, ideally 1 minute or less
- The bus stop display, which receives shall display continuously until the next set of data is received
- The information is to be pushed/pulled from the central server. Passenger information will be pushed/pulled in real time while all other information shall be scheduled during non-peak hours
- Aesthetic requirements such as fonts, colors, rows per page, display time to be remotely configurable and displayed for at least 10 sec. before.
- The display shall be capable of displaying at least 2 lines of information pertaining to running buses with fixed & scrolling method in any part of display.
- The system shall provide real time data on schedules, timings, delays and others.
- The system's information (ETA, stop information and others) delivery, representation shall be in standard format across all stops.
- The ETA should have a maximum deviation of 5 minutes from actual bus running time
- Should display Service/Route number, Origin, Destination and via stops
- Should support Englishand Kannada languages
- Should support 2-Line (100 mm/line) and 1-line (200 mm) character display
- Automatic brightness control as per ambient light conditions. Support minimum of 50 steps.
- Flicker free display
- Support text in still (fixed), scrolling and combined

f. Bus Operations and Analytics Platform (BOAP)

The purpose of Pervasive Platform shall be augmenting the native intelligence capabilities of applications. It shall be expected that the level of maturity of reporting and analytics would vary across applications. System shall provide a pervasive intelligence data platform layer, which can get linked to disparate repositories and can extend the analytics capabilities of sub-systems. This will ensure a single view of performance matrix is given to the BMTC to help them make better decisions.
The BOAP shall be a comprehensive and integrated suite of analytical solutions designed to bring greater insight to broadest audience of users allowing them to have self-service access to relevant and actionable intelligence from relevant data sources (of which they have access to).
The BOAP shall consist of Managed Reporting, OLAP Analysis, Ad-hoc querying, Dash boarding, Score carding, Business Activity Monitoring, MS Office Integration. All these need to be provided from a single BI and shall be available as a web application.
Ad Hoc Query Capability: BOAP shall be providing an analytical Solution enabling a web-based ad-hoc analysis Solution where end user can interact with logical view of information creating charts, pivot tables, reports, gauges, dashboards etc.
It shall have facility to save the queries and edit the same in future to derive newer queries.
It shall have facility to create ad hoc queries through use of simple business terms for querying the data sources.
The BI shall allow derived or calculated data like ratios that is not available in the data source for the purpose of comparison or analysis like Arithmetic (sum, difference, round up or down, etc.), Percentage (% difference, % total, etc.), Analytic (Max, Min, average etc.).
The BOAP shall have facility to create ad hoc queries through use of simple business terms for querying the data sources.
It shall have the ability for the users/operators to create their own charts and graphs based on their requirement. It shall have the ability to convert a tabular report into a chart by passing the relevant parameters.
BOAP platform shall have the ability to define their own measures and calculative fields on the fly and be able to save the new columns that are created as a self-

service feature and shall not depend on IT to do it. The system should allow the user/operator to save these measures and re-use them in future.
BOAP shall be able to add comments, remarks on a report and other users and shall be able to view this comment history so that they know the justification / history.
Save and Share Capability: After end user spends time and creates, adds, deletes, changes the pivot table views, he/she shall be able to save these changes and share the updated view with group of users.
Ability to export the data or report to spread sheets including graphics and to flat file.
Ability to export the reports into CSV, pdf &xls html formats
Ability to directly send the report for printing on a LAN printer / personal printer
Dashboard Capability: rich, interactive, role based, easy to understand web-based dashboard providing access to live reports, prompts, charts, tickers, pivot tables and graphics.
Multi-Channel Report Publishing Capability: BI shall provide a scalable reporting server capable of generating richly formatted reports from multiple sources (SQL server, Oracle, Informix, Sybase, Files, XML,URL, Sybase SQL Anywhere(JDBCODBC bridge compliance connection)), in multiple formats (word, excel, rtf, pdf and xml) published on multiple channels (email, webdav, print, ftp to file server).
The BOAP shall be able to connect to most of the OLAP cubes like SQL, MS-SQL, DB2, Oracle, Hyperion.
Microsoft Office Integration Capability: Given that most users/operators would use office documents like word, excel and power point documents in day to day operations, the BI platform shall be providing an ability to embed up-to-minute application data in MS office documents while preserving security policy to access data.
OLAP Analysis Capability: Ability to do ROLAP, MOLAP and HOLAP analysis, depending on the requirement, needs to be catered by the BI platform.
The BOAP platform shall allow different levels of nesting to integrate several rows and columns of data. e.g. build analysis by geography and allow to nest analysis

by entity and time within a geography.
The BOAP shall allow creation of logical grouping of data based on user defined criteria. e.g. pattern matches, value thresholds.
The BOAP platform shall not only focus on report collection but also provide ability for insight driven action. This means enabling business users to navigate quickly to troubleshoot reported issues (root cause drill downs) and to act in response to business/functional events.
The BOAP platform layer shall be able to work seamlessly with any popular data source, business application and security infrastructure.
Reports can be scheduled based on occurrence of a business event / business threshold being breached in BMTC.
The BOAP shall have ability to integrate with LDAP / ADS / any other enterprise authentication mechanism for single sign on.
The BOAP platform shall extract data from ITS suite (AVLS, Scheduling & dispatch, IMS)
The BOAP shall bring the ticketing, tracking data and other operation data onto a common platform and is to be used for objectively assessing the volume and quality of bus services provided by BMTC.
The BOAP shall provide a platform to consolidate/cross-verify AVLS and AFCS data against each other and manually enter the missing data.
The BOAP shall enable BMTC's depot level operations team to monitor performance- real-time as well process whole day's data at trip-level with facility to compile performance with identifiable action points.
Operation Reports to be generated but not limited to the following: • On-time performance of fleet overall or based on depot or bus-stop level. • Scheduled KMs vs Actual KMs with ability to drill down for detailed break-up. Information shall be at route level • Speed of bus between two points • Per stop, per bus revenue. Stop-wise, route wise and bus-wise revenue

- Vehicle off road report with reasons
- Earning Per KM - Route wise, trip wise, bus wise, crew wise
- Earning Per Bus
- Earning per Passenger
- Avg. Vehicle Utilization
- Ridership per effective km
- Ridership per Bus
- Denomination-wise Ticketing
- Bus behavioral analysis for comparative trip analysis between multiple stages
- Schedule adherence trend of duty, trips, depots, inter-depot etc.
- Indicative malpractice/fraud detection tool
- Ridership analysis of routes–Origin Destination (OD) pair-wise, stop-wise, revenue-wise
- Crew performance analytics
- Ticket sale analysis – denomination-wise, OD pair-wise etc.
- Number of Passengers per KM (route wise, trip wise, bus wise)
- Speed Adherence impact on Revenue
- Speed Adherence impact on Passenger Count
- Time Adherence impact on Revenue
- Run time between two stops, per bus , per route based on hour/day/month
- Stationary Bus Alert (for a predefined time decided by BMTC)

The data required for generation of operational report shall be either from the system developed under this RFP or from existing ITS system of BMTC. BMTC will share require data from existing ITS system.